

## Executive Summary

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Fire departments in the United States respond to nearly 2 million fire calls each year. The U.S. fire problem, on a per capita basis, is one of the worst in the industrial world. Thousands of Americans die each year, tens of thousands of people are injured, and property losses reach billions of dollars. There are huge indirect costs of fire as well—temporary lodging, lost business, medical expenses, psychological damage, pets killed, and others. These indirect costs may be as much as 8 to 10 times higher than the direct costs of fire. To put this in context, the annual losses from floods, hurricanes, tornadoes, earthquakes, and other natural disasters combined in the United States average just a fraction of those from fires. The public, the media, and local governments are generally unaware of the magnitude and seriousness of the fire problem to individuals and their families, to communities, and to the nation.

### PURPOSE AND SCOPE

The National Fire Data Center (NFDC) of the U.S. Fire Administration (USFA) periodically publishes *Fire in the United States*—a running 10-year statistical overview of the fires in the United States with the focus on the latest year in which data were available at the time of preparation. This report is designed to arm the fire service and others with information that motivates corrective action, sets priorities, targets specific fire programs, serves as a model for state and local analyses of fire data, and provides a baseline for evaluating programs.

This Thirteenth Edition covers the 10-year period from 1992 to 2001, with emphasis on 2001. The primary source of data is from the National Fire Incident Reporting System (NFIRS). National Fire Protection Association (NFPA) annual survey results, mortality data from the National Center for Health Statistics (NCHS), data from state fire marshals offices or their equivalents, and statistics from the U.S. Census Bureau and the Consumer Price Index are also used. Because of the time it takes for states to submit data to USFA from the thousands of fire departments that participate in NFIRS, then edit and obtain corrections, and analyze and display the results, the publication lags the date of data collection. Fortunately, the fire problem does not change very rapidly so the data are usually quite representative of the situation in the year of publication as well.

The attacks on the World Trade Center and the Pentagon on September 11, 2001, resulted in the deaths of 2,451 civilians and 341 firefighters<sup>1</sup> and a property loss estimate of more than

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<sup>1</sup> These 341 casualties do not include three WTC fire safety directors who received benefits from the Department of Justice's Public Safety Officers' Benefits Program.

\$33 billion. For the most part, these statistics are omitted from this report as such extreme losses distort the historical picture of U.S. fires and fire losses over a period of time.

## LOSSES BY PROPERTY TYPE

Annual deaths from fire in the United States were estimated at 12,000 in 1974, the year in which the USFA was established. At that time, a goal was set for reducing this number by half within a generation. This goal was met, and in 1999 civilian deaths were at their lowest level (3,570).

Table 1 presents the rate of U.S. fire losses for all property types in 2001 and the 10-year trends.<sup>2</sup> Deaths and injuries per million population reached 10-year lows, and fires per million population were up slightly from their 2000 low. The death rate of 13 per million population is half what it was in the late 1970s. Nevertheless, the United States has a fire death rate two to two and one-half times that of several European nations and at least 20 percent higher than many. The World Fire Statistics Centre ranks the United States as 20th of 25 industrialized nations.

**Table 1. Fire and Fire Loss Rates in All Properties**

Loss Measure	2001	10-Year Trend (percent)
Fires/Million Population	6,080	-23.9
Deaths/Million Population	13.1	-29.6
Injuries/Million Population	71.2	-38.3
Dollar Loss/Capita*	37.1	-6.0

\*Adjusted to 2001 dollars.

Sources: NFPA, Consumer Price Index, and U.S. Census Bureau

Another way to look at the U.S. fire situation is the loss per fire. Table 2 summarizes the losses per 1,000 fires by general property type and the dollar loss per fire; the 10-years trends for these property types are also included. Deaths and injuries per 1,000 fires in 2001 in these properties were either lower or equal to those in 1998, the last year covered by the 12th edition of this publication.

The number of fires, deaths, and injuries in all properties have spiraled downward since 1974 and in the 10-year period 1992–2001, the downward trends were sharper than in the last reported 10-year cycle 1989–1998 (Table 3).

<sup>2</sup> Chapter 1 describes in detail the methodology used in this report, including how trends are calculated and how “unknown” records are allocated.

**Table 2. Losses Per Fire in 2001 and Trends by General Property Type**

General Property Type	2001			10-Year Trend (percent)		
	Deaths/ 1,000 Fires	Injuries/ 1,000 Fires	Dollar Loss/ Fire	Deaths	Injuries	Dollar Loss
Residential	7.4	36.4	\$13,200	-8.8	-23.3	+3.9
Non-Residential	1.0	14.7	20,600	-31.6	-33.8	-13.7
Vehicle	1.7	4.8	3,900	+0.9	-39.8	+28.3
Outside	0.1	1.3	200	-30.0	-26.1	-5.4
Other	0.9	11.1	3,100	-53.8	-55.0	-35.3

Sources: NFIRS and Consumer Price Index

**Table 3. 10-Year Trends for Property Fires and Losses (percent)**

Property	Fires	Deaths	Injuries	Dollar Loss*
<b>All Properties</b>	<b>-15.5</b>	<b>-21.8</b>	<b>-31.3</b>	<b>+4.7</b>
<b>Residential Properties</b>	<b>-21.0</b>	<b>-18.5</b>	<b>-28.9</b>	<b>+6.1</b>
One-/Two-Family Dwellings	-23.1	-15.6	-27.0	+4.3
Apartments	-15.8	-25.7	-33.3	+13.9
Other Properties	-3.1	-75.8	-34.3	+27.7
<b>Non-Residential Properties</b>				
Structures	-21.8	-48.4	-45.7	-14.3
Mobile Properties	-17.1	-32.4	-41.8	+18.9
Outside	-13.3	-28.7**	+11.9**	-14.5
Other	+5.0			+95.1

\*Adjusted to 2001 dollars.

\*\*Combines outside and other deaths and injuries, as the "other" category was not calculated separately.

Sources: NFPA and Consumer Price Index

***Residential Properties***

Fire statistics for three major residential property groups were examined: one- and two-family dwellings, apartments, and other properties such as hotels/motels, rooming houses, and dormitories. A subset of one- and two-family housing, mobile properties used as fixed residences, was also studied.

One- and two-family dwellings, where 73 percent of the population lives, dominate the residential fire picture in 2001: 73 percent of fires, 78 percent of deaths, 67 percent of injuries, and 76 percent of dollar loss. Cooking is the leading cause of fires and injuries in these structures. Smoking is the leading cause of deaths, followed closely by arson. These two causes alone are responsible for 42 percent of deaths. Arson is the leading cause of dollar loss. Heating is the second leading cause of one- and two-family dwelling fires (19 percent) slightly behind cooking (25 percent). Heating plays a much less prominent role in other dwelling fires. Perhaps homeowners are not as attentive as apartment management in maintaining their heating systems. This could be an area of fire prevention focus.

The leading causes discussed above remain unchanged year after year. The children playing cause, however, has dramatically decreased. Each year in the mid 1980s, children playing was reported as the cause of up to 22,000 fires and more than 400 deaths. In 2001, children playing fires dropped to 6,000 and deaths to 89. Some of this decline may be due to definitional changes from NFIRS 4.1 to 5.0, but certainly public education efforts that have targeted this problem have played a major role in the decline.

A mobile home used as a fixed residence (also known as a type of manufactured housing) is a subset of one- and two-family dwellings. Deaths and injuries per fire incident are higher in these dwellings than in residential properties overall. Ten-year trends, however, in fires and losses have declined notably (between 48 and 57 percent) due in large part to strict standards established by HUD in 1976 for improving fire safety and by the use of improved building materials.

In 2001, apartments represented 23 percent of residential property fires, 18 percent of deaths, 29 percent of injuries, and 20 percent of dollar loss. The 10-year trend in the number of fires declined, although at a slower rate than one- and two-family residences (16 vs. 23 percent). On the other hand, the decline in the death trend was sharper in apartments. Cooking leads the causes for apartment fires by a factor of five over the next leading cause. Smoking accounts for 35 percent of apartment deaths, but its 10-year trend has declined 27 percent. Arson fires and injuries have trended down more than 40 percent, but deaths have increased 34 percent over 10 years. Apartments tend to be more regulated by building codes than one- and two-family dwellings. Most are rental properties, often falling under stringent fire prevention statutes. Because apartment buildings usually have large clusters of similar people, prevention programs can be tailored to the cause profiles of apartment buildings in different areas of the community. Further study is recommended on the cooking, smoking, and arson problems in apartments.

Other residential properties include rooming houses, dormitories, home hotels, halfway houses, hotels/motels, and miscellaneous and unclassified properties reported as residences. For all loss measures, this category represents only 3 to 5 percent of the residential fire situation. Still, in 2001, there were 13,000 estimated fires in these structures. The number of fires has decreased slightly (3 percent) over the 10-year period, but deaths and injuries have decreased 76 and 34 percent, respectively. Cooking was the leading cause of these fires by a factor of three over the next leading cause. Deaths and injuries are too few to draw meaningful comparisons.

For both one- and two-family residences and apartments, statistics were compiled for where fires started and when they occurred (time of day, month of year) to determine whether any changes in trends emerge. Findings in this report are unchanged from prior years. The kitchen is the area where more fires start than any other location in the home. This is consistent with cooking as the major cause of fires. Cooking fires and injuries in apartments, however, have a higher incidence than in one- and two-family dwellings. Deaths in both structures are highest in living/family rooms and bedrooms. This finding is consistent with smoking as the cause, perhaps because people fall asleep smoking in bed or on upholstered furniture.

In both types of homes, fires and injuries are highest between 5 and 7 p.m.—the cooking hours—and lowest from 4 to 6 a.m. when people are asleep. Deaths peak in the early morning hours from midnight to 5 a.m. Here, smoldering materials from careless smoking may ignite and trap the sleeping residents. Arson is another cause of early morning fires resulting in deaths. Fires and deaths are greatest in the winter months. This is probably because heating fires are added to other causes and because seasonal factors such as the presence of dry Christmas trees and the use of holiday candles contribute to the residential fire problem.

### *Non-Residential Properties*

Non-residential properties include industrial and commercial properties, institutions (such as hospitals, nursing homes, and prisons), educational establishments, storage properties, and mobile properties. They are divided into three categories: structures, vehicles, and outside/other fires. Two changes have been made since the publication of the 12th edition. Detached residential garages are now considered storage structures, and vacant and under construction properties are no longer a separate property type but rather are considered with the primary property type of the new construction or the primary property type of the previous property use.

Although the 2,451 civilians killed, 800 injured, and \$33 billion in property loss due to the World Trade Center and Pentagon attacks on September 11, 2001, are considered non-residential property losses, they have been omitted from the following discussion as explained previously.

As derived from NFPA's annual survey, only 7 percent of fires, 2 percent of deaths, and 8 percent of injuries are attributed to 2001 non-residential property fire incidents. These properties, however, account for a disproportionately large annual dollar loss, 31 percent. The small percentages of fires, deaths, and injuries should not obscure the fact that they represent thousands of fires and hundreds of casualties. Table 4 provides a snapshot of the percentage of non-residential structure losses in 2001 by property type. The dollar loss per fire in non-residential

**Table 4. 2001 Non-Residential Structure Fires and Fire Losses by Property Type (percent)**

Property Type	Fires (47,785 cases)	Deaths (47 cases)	Injuries (701 cases)	Dollar Loss (\$986.2 million)
Public Assembly	4.5	2.1	3.6	5.1
Eating/Drinking	8.0	6.4	7.3	8.4
Educational	5.7	0.0	4.6	3.9
Institutional	5.9	12.8	13.1	1.4
Stores, Offices	18.1	10.6	21.7	27.8
Basic Industry	2.7	10.6	2.8	5.8
Manufacturing	7.5	10.6	16.5	20.3
Storage	18.1	23.4	13.3	16.7
Residential Garages	7.0	6.4	6.4	2.7
Other/Outside Structures	22.5	17.0	10.8	7.6

Source: NFIRS

structures is higher than in residential structures (\$20,600 vs. \$13,200) primarily because buildings are often larger and the contents may have high value. The per-fire dollar losses for each of the non-residential structures are shown in Chapter 4, Table 17.

Arson has always been the leading cause of all non-residential structure fires and dollar loss. In fact, arson property losses are twice those of the next leading cause category, and represent 30 percent of all property losses.

In 2001, vehicle fire incidents accounted for one in every five fire department responses. Transportation vehicles accounted for 13 percent of U.S. fire deaths, 9 percent of fire injuries, and 14 percent of dollar losses. Ten-year trends for vehicle fires have declined 17 percent, while deaths and injuries have decreased notably (32 and 42 percent, respectively). These declines probably result from the greater attention paid toward designing safety into newer vehicles. Dollar losses have increased 19 percent, largely due to the increasingly higher cost of transportation vehicles. Automobile statistics dominate the transportation vehicle category.

The outside and other properties category includes all fires that are not structure or vehicle fires. The primary components of this category are trees, brush, and grass fires; outside with value fires; and refuse fires. Trees, brush, and grass fires account for half of the outside and other fires. Outside and other fires comprise roughly 50 percent of all fires in the United States, an average of 917,000 fires each year. Although large in number, they accounted for only 1 percent of deaths and 6 percent of injuries.

Setting a value for outside fire damage is difficult. Damage from these fires often requires labor beyond that of the fire department to clean up and restore the area. They cause esthetic problems that are intangible. Some outside fires spread to structural properties and may be reported as structural fires rather than an outside fire with exposure to structures. Outside fires can also have other indirect costs, such as the financial impact on agricultural communities where a fire destroys crops. Additionally, forest fires and other wildfires are not reported to NFIRS if the state or federal agency with principal authority for fighting the fire does not participate in NFIRS.

The leading cause of all forms of outside fires is arson, with many thought to be set by children and adolescents. However, determining the cause of these fires is often difficult and results in most outside and other fires having an unknown cause. Apportioning such large numbers of “unknowns” to the “knowns” may distort the true picture.

## DETECTION AND EXTINGUISHMENT SYSTEMS

Structures equipped with smoke alarms or automatic extinguishing systems (AESs)—most often sprinkler systems—are thought to account for a significant part of the decrease in reported fires and deaths over the past two decades.

Over 90 percent of U.S. households now have at least one smoke alarm. Households with no installed alarms have a greater incidence of reported fires than those with functioning smoke alarms. Either people with alarms are more safety conscious or the alarms allow early detection and extinguishment so that the fires are not reported. Anecdotal information suggests that reported fires are more prevalent in older, less well cared for homes, and these are less likely to be equipped with a smoke alarm. Table 5 shows the performance of smoke alarms in residential properties in 2001. Only 67 percent of households that had fires were reported to be equipped with a smoke alarm, slightly below the national average. Only 60 percent of households where a fire death occurred were equipped with a smoke alarm; of those, 39 percent did not operate. These results clearly indicate that smoke alarms do contribute to saving lives.

**Table 5. 2001 Smoke Alarm Performance in Residences (2001) (percent)**

Residential Property Type	Present/Operated		Present/Did Not Operate		No Alarm	
	Fires	Deaths	Fires	Deaths	Fires	Deaths
All Residences	51.5	39.4	15.7	20.7	32.8	39.9
One and Two Family	45.0	34.3	16.6	19.8	38.3	46.0
Apartments	71.6	70.3	14.4	23.5	13.9	6.2

Note: "Unknowns" apportioned.

Source: NFIRS

One- and two-family homes in which fires occur have, proportionally, fewer alarms installed than in apartments that experience fires. This may be because apartment smoke alarms are often provided by landlords and are more often required by law than one- and two-family dwellings.

The fact that smoke alarms worked in 70 percent of apartments in which a death occurred is troublesome. Explanations include the possibility that hallway or apartment alarms operated after the victims were overcome or that there were fewer ways to escape, especially on higher floors. It also may be linked to the lower socioeconomic level of many apartment dwellers. This situation suggests the need to provide sprinklers in apartments and to emphasize fire prevention to occupants. Additionally, multiple false alarms may occur in apartments due to smoke from burning food or pots. Because of these repetitive incidents, tenants may be more inclined to ignore the fire alarm.

Another surprising fact is that in residences where a death occurred, a higher percentage of smoke alarms did not operate in apartments than in one- and two-family homes. This result is unexpected as apartment alarms are more likely to be hardwired into the electrical system and professionally maintained than alarms in dwellings.

Residential sprinklers were found in fewer than 3 percent of homes that had reported fires in 2001. The actual number of sprinklers installed in residences may be underestimated since an operating sprinkler could have extinguished a fire and no call was made to the fire department.

A higher percentage of apartments were equipped with sprinklers than one- or two-family dwellings (8 percent vs. 1 percent). Use of sprinklers in apartments appears to be growing.

Sprinklers and other AEs are more prevalent in non-residential structures (15 percent). This is not unexpected since commercial properties and public assembly sites tend to occupy large structures that have been built to strict construction codes. Also, owners and proprietors of such sites have a great need to protect their property.

The installation of sprinklers provides significant protection against fire. However, this conclusion cannot be drawn from NFIRS data alone since NFIRS combines properties of different size and values in the same property class. Sprinkler systems are more likely to be installed in large and highly valued properties than in small, inexpensive ones.

## **ETHNIC, AGE, AND GENDER CHARACTERISTICS OF VICTIMS**

Fire losses affect all groups and races, rich and poor, North and South, urban and rural. But the problem is higher for some groups than for others. African Americans and American Indians have much higher death rates per capita than the national average. African Americans comprise a large and disproportionate share of total fire deaths, accounting for 25 percent of fire deaths—twice as high as their share of the overall population.

Over the past 10 years, nearly twice as many men have died in fires as women, although the proportion has narrowed slightly in recent years. The reasons for the disparity of fire injuries between men and women are not known for certain. Suppositions include the greater likelihood of men being intoxicated, the more dangerous occupations of men (most industrial fire fatalities are males), the greater use of flammable liquids by men, and the fact that risk taking is predominately a male attribute. After age 60, more females died than did males, but this is because the female-to-male ratio increases (i.e., women live longer than men). Male fire deaths, by contrast, are very much higher in the mid-life years (20–49). The pattern of injuries by gender and age is somewhat the same as the one for deaths. Smoking fires are the leading cause of death to older adults and the second leading cause of their injury, behind cooking.

People with limited physical and cognitive abilities, especially the very young and very old, are at a higher risk of death and injury from fire than other groups. In 2001 alone, USFA estimates that 2,900 children under the age of 15 and 2,200 older adults (65 and older) were injured. Fire deaths for children under the age of 15, as reported from death certificates, numbered 599; an additional 1,250 deaths were reported for older adults. These two age groups accounted for 46 percent of 2001 reported fire deaths and 25 percent of estimated fire injuries. Most of these injuries and deaths occurred in the home, and a large proportion occurred while the victims were asleep.

Children under age 5 are 40 percent more likely to die in a fire than the general population. As the age of the child increases, the likelihood of dying in a fire decreases. African American and American Indian children are nearly twice as likely to die in a fire than white or Asian children.

As baby boomers enter retirement age, the U.S. demographic profile is expected to change dramatically. Over the coming decades, the older population will increase to nearly 20 percent of the total population. Therefore, a corresponding increase in fire deaths and injuries among older adults is likely.

## **FIREFIGHTER CASUALTIES**

The U.S. Fire Administration currently reports that a total of 449 firefighters perished in 2001, 341 of whom were victims of the World Trade Center attacks. The analysis shown here is based on the original 443 in that year's annual report, which do not include three WTC fire safety directors who received benefits from the department of Justice's Public Safety Officers' Benefits Program nor three additional firefighter fatalities that subsequently have been reported to USFA where the incident date causing the death was in 2001. Excluding the WTC deaths, 66 of the 102 firefighters who died were engaged in emergency services, and 38 of these occurred directly during fireground operations. The fatalities included 27 career firefighters and 75 volunteers; 5 were women. Unlike the previous four editions of this document in which the firefighter fatality trend decreased, the 10-year trend from 1992 to 2001 increased 30 percent. Although this jump appears acute, the total deaths are small enough that a change of even a few deaths in a year may dramatically impact the 10-year trend line.

As in all previous years, the most frequent cause of deaths was stress or overexertion. Of the 102 firefighter deaths in 2001, 44 died from heart attacks or strokes. Of these, 33 were over the age of 40, and 24 were over the age of 50. In fact, from 1996 through 2001, 256 firefighters have died as a result of heart attacks and strokes. Recognizing this danger, the USFA has outlined programs, procedures, and activities that encourage firefighters to improve their health regimen.

More firefighters died (14) in 2001 during training exercises than in any of the previous 10 years; 9 were from heart attacks.

In 2001, 82,250 firefighters were injured on duty, half of which were at the fireground. When compared to the 20,300 civilian injuries during this period, firefighters are at considerable risk. Sixty-nine percent of these injuries occurred in residential dwelling fires and 19 percent in non-residential structures. The total number of firefighter injuries in 2001, however, dipped to their lowest point in 10 years, and the overall 10-year injury trend declined 17 percent. Twenty-one firefighters were injured for every 1,000 structure fires in 2001, a cause for concern and a problem that should be investigated further.

The percentages of injuries by firefighter age have not changed much over the past 10 years. More than one-third of injuries occurred to firefighters aged 30–39. The leading cause of injury

among younger firefighters relates to smoke inhalation, and among older firefighters strains and sprains are more common injuries. These results relate to physical fitness variations with age, to the effect of age on assignments, and perhaps to the bravado of younger firefighters.

Adjusted for the unknowns, 96 percent of injuries occur at the fire scene, and 78 percent were injured extinguishing the fire, neutralizing the incident, or providing suppression support.

## REGIONAL AND STATE PROFILES

The fire problem varies from region to region and state to state because of variations in climate, socioeconomic status, education, demographics, and other factors. Four states (Alaska, Arkansas, Delaware, and Mississippi) have fire death rates that exceed 25 deaths per million population; this rate is one of the worst among the world's nations. Eleven states, mostly situated in the Southeast, have death rates per million population between 17 and 25. Twenty-three states have fire death rates below the national rate of 13.1 per million population. There has been great progress by states in lowering both the absolute number of deaths and the deaths per capita. As recently as 1996, 12 states (including the District of Columbia) had 25 or more deaths per million population; in 2001, only 4 states had 25 or more.

Ten states in 2001, mostly large population states, account for 45 percent of the national total U.S. fire deaths as reported by state fire marshal offices. Unless their fire problems are significantly reduced, the national total will be difficult to lower.

## CONCLUSIONS

This report clearly shows that the fire problem in the United States is improving. Ten-year trends are down. Deaths and injuries to civilians and firefighters are down. Per capita rates are down. Several factors have likely contributed to these trends:

- Smoke alarms, whose usage has become nearly universal over the past two decades.
- Sprinklers, which quickly combat incipient fires, especially in non-residential structures and recently in apartments. Public education programs could better inform homeowners of their value in residences.
- Fire codes, which have been strengthened.
- Construction techniques and materials, which have been specifically targeted to fire prevention.
- Public education at the community, county, state, and federal levels, which seems to be increasing.
- Firefighter equipment and training, which have improved.

Even considering these positive trends, the United States still has a major fire problem vis-à-vis other industrialized nations. The study and implementation of international fire prevention

programs that have proved effective in reducing the number of fires and deaths should be considered.

Other areas of concern include:

- The very young and very old continue to be at high risk.
- Certain ethnic groups are at enormous risk to fire injuries and death.
- Many deaths occur in residences with operating smoke alarms. The 70 percent of apartment fatalities where smoke alarms were operating is a subject for further study.
- Arson is an enormous problem in the United States, especially to outside and non-residential structure properties. Economically, arson accounts for 25 percent of property loss from all fires, double that of the next leading cause.
- The true effectiveness of automatic extinguishment systems needs to be examined.
- Heating is the second leading cause of fire in one- and two-family dwellings. Public awareness programs alerting residents to potential dangers from heating sources should prove effective.
- Aggressive policies need to continue in order to lessen the high proportion of firefighter deaths due to heart attacks.
- Twenty-one firefighters are injured per 1,000 structure fires. Programs to reduce this rate should be developed.
- Contiguous states often have similar fire profiles. A study to determine reasons for this could uncover severe problem areas or, conversely, reveal best practices.
- Many records submitted to NFIRS by participating fire departments provide either incomplete or no information in some of the fields. Additionally, in preparing this report, it is assumed that participating fire departments have reported 100 percent of their fire incidents; however, this is not always the case. The completeness of all the information in the NFIRS modules will contribute to the refinement and confidence level of future analyses.

If we could understand the relative importance of these factors to lessening the fire problem, resources could be better targeted to have the most impact.